CLAIMS

Sub C1

1. A method for removing electrically conductive material from a face surface of a microelectronic substrate, comprising:

spacing a first conductive electrode apart from the microelectronic substrate;

spacing a second conductive electrode apart from the microelectronic substrate;

disposing an electrolyte between the microelectronic substrate and both the first and second electrodes, with both the first and second electrodes in fluid communication with the electrolyte;

removing at least part of the conductive material from the microelectronic substrate by passing a varying current through at least one of the first and second electrodes while the first and second electrodes are spaced apart from the conductive material of the microelectronic substrate; and

removing gas from a region between the microelectronic substrate and at least one of the first and second electrodes while the conductive material is removed from the microelectronic substrate.

2. The method of claim 1, further comprising:

interposing a polishing pad having a polishing surface between the face surface of the microelectronic substrate and both the first and second electrodes; and

electrically coupling the electrodes to the face surface of the microelectronic substrate through the polishing pad, with one of the electrodes defining an anode and the other electrode defining a cathode.

3. The method of claim 1 wherein removing the conductive material includes oxidizing the conductive material by passing the varying current through at least one of the first and second electrodes and the conductive material, and engaging the microelectronic substrate with a polishing surface of a polishing pad while passing the varying current through at least one of the first and second electrodes.

4. The method of claim 1, further comprising:

interposing a polishing surface between the face surface of the microelectronic substrate and both the first and second electrodes; and

moving the electrodes and/or the microelectronic substrate to electrically couple the electrodes with a substantial portion of the face surface through the polishing surface, with one of the electrodes defining an anode and the other electrode defining a cathode.

5. The method of claim 1, further comprising:

interposing a polishing surface between the face surface of the microelectronic substrate and both the first and second electrodes; and

coupling the first and second electrodes to a substantial portion of the face surface through the polishing surface.

6. The method of claim 1, further comprising providing for fluid communication between the first and second electrodes proximate to the microelectronic substrate, with one of the electrodes defining an anode and the other electrode defining a cathode.

7. The method of claim 1 wherein positioning the first and second electrodes proximate to the microelectronic substrate includes positioning surfaces of the electrodes to face downwardly toward the microelectronic substrate with the

first and second electrodes being spaced apart from each other to define a gas removal channel therebetween, and wherein removing the gas includes removing the gas through the gas removal channel.

8. The method of claim 1 wherein positioning the first and second electrodes proximate to the microelectronic substrate includes positioning surfaces of the electrodes to face upwardly toward the microelectronic substrate.

9. The method of claim 1 wherein positioning the first and second electrodes proximate to the microelectronic substrate includes positioning surfaces of the electrodes to face upwardly toward the microelectronic substrate, and wherein the method further comprises engaging the microelectronic substrate with a polishing surface of a polishing pad adjacent to at least one of the first and second electrodes, and further wherein removing gas includes conducting the gas through an upwardly facing channel in the polishing pad.

10. The method of claim 1 wherein removing the gas includes applying a vacuum to the region between the microelectronic substrate and at least one of the first and second electrodes.

11. The method of claim 1 wherein removing the gas includes introducing ultrasonic energy into a fluid positioned between the microelectronic substrate and at least one of the first and second electrodes.

12. The method of claim 1 wherein removing the gas includes directing a fluid into the region between the microelectronic substrate and at least one of the first and second electrodes and entraining the gas in the fluid.

13. The method of claim 1, further comprising generating the gas by passing the current through the conductive material.

14. The method of claim 1 wherein passing a varying current through the first and second electrodes includes passing an alternating current through the first and second electrodes.

15. The method of claim 1 wherein passing a varying current through the first and second electrodes includes passing a plurality of direct current pulses through the first and second electrodes.

16. The method of claim 1 wherein removing the gas from a region includes removing the gas from a region between a downwardly facing surface of the microelectronic substrate and an upwardly facing surface of at least one of the electrodes.

17. The method of claim 1 wherein removing the gas from a region includes removing the gas from a region between an upwardly facing surface of the microelectronic substrate and a downwardly facing surface of at least one of the electrodes.

18. The method of claim 1, further comprising rotating at least one of the microelectronic substrate and/or at least one of the electrodes at a rate sufficient to direct the gas radially outwardly and away from the microelectronic substrate.

19. The method of claim 1, further comprising removing the gas through a gas removal channel from a region proximate to the microelectronic substrate.

20. The method of claim 1, further comprising conducting the gas along a gas removal surface from a region proximate to the microelectronic substrate.

21. The method of claim 1 wherein the first and second electrodes each have a surface facing downwardly toward the microelectronic substrate during operation, and wherein removing the gas includes removing the gas through a gas removal channel recessed into at least one of the downwardly facing surfaces.

22. The method of claim 1 wherein the first and second electrodes each have a surface facing downwardly toward the microelectronic substrate, and wherein removing the gas includes positioning at least one of the downwardly facing surfaces at a non-horizontal orientation to conduct the gas upwardly and away from the region proximate to the microelectronic substrate.

23. The method of claim 1 wherein removing the gas includes conducting the gas through pores in a polishing pad adjacent to the microelectronic substrate.

24. The method of claim 1 wherein removing at least part of the conductive material includes removing a first portion of the conductive material, and wherein the method further comprises:

aligning a first portion of the microelectronic substrate with a first portion of a polishing pad proximate to at least one of the electrodes and having first electrical characteristics;

aligning a second portion of the microelectronic substrate with a second portion of the polishing pad having second electrical characteristics different than the first electrical characteristics;

engaging the microelectronic substrate with the polishing pad; and

moving at least one of the microelectronic substrate and the polishing pad relative to the other to remove a second portion of the conductive material.

25. A method for removing electrically conductive material from a face surface of a microelectronic substrate, comprising:

engaging the microelectronic substrate with a polishing surface of a polishing pad;

coupling the conductive material to a source of electrical potential;

removing at least a portion of the conductive material from the microelectronic substrate by passing a varying current through the conductive material while moving at least one of the microelectronic substrate and the polishing pad relative to the other and while the microelectronic substrate is engaged with the polishing pad; and

removing gas from a region adjacent to the microelectronic substrate and/or an electrode at least proximate to the microelectronic substrate while the conductive material is removed from the microelectronic substrate.

26. The method of claim 25, further comprising:

disposing an electrolytic fluid adjacent to the face surface of the microelectronic substrate;

interposing the polishing surface between the face surface and the first and second electrodes;

coupling at least one of the first and second electrodes to the source of electrical potential; and

electrically coupling the first and second electrodes to the face surface of the microelectronic substrate through the polishing surface of the polishing pad via the electrolytic fluid.

27. The method of claim 25, further comprising biasing the polishing surface against the microelectronic substrate with an electrolytic fluid.

28. The method of claim 25, further comprising directing a first portion of an electrolytic fluid through the polishing surface to an interface between the polishing surface and the microelectronic substrate, and removing the gas by entraining the gas with a second portion of the electrolytic fluid.

29. The method of claim 25, further comprising positioning both first and second electrodes to face toward the face surface of the microelectronic substrate and coupling at least one of the electrodes to the source of electrical potential.

30. The method of claim 29 wherein engaging the microelectronic substrate with a polishing pad includes engaging a first portion of the microelectronic substrate with a first portion of the polishing pad depending from a first conductive electrode and engaging a second portion of the microelectronic substrate with a second portion of the polishing pad depending from a second conductive electrode.

31. The method of claim 25, further comprising aligning a first portion of the microelectronic substrate with a first portion of the polishing pad having first electrical characteristics and aligning a second portion of the microelectronic substrate with a second portion of the polishing pad having second electrical characteristics different than the first electrical characteristics.

32. The method of claim 25, further comprising engaging the microelectronic substrate with abrasive elements disposed in an electrolytic fluid adjacent to the face surface of the microelectronic substrate.

33. The method of claim 25, further comprising engaging the microelectronic substrate with abrasive elements fixedly attached to the polishing pad.

34. The method of claim 25, further comprising rotating at least one of the microelectronic substrate and the polishing pad relative to the other while the microelectronic substrate is engaged with the polishing pad.

35. The method of claim 25 wherein the polishing pad is elongated along an axis and wherein the method further comprises advancing the polishing pad along the axis.

36. A method for removing electrically conductive material from a microelectronic substrate, comprising:

aligning a first portion of the microelectronic substrate with a first portion of a material removal medium having first electrical characteristics and aligning a second portion of the microelectronic substrate with a second portion of the material removal medium having second electrical characteristics different than the first electrical characteristics;

engaging the conductive material with a polishing surface of the material removal medium; and

removing at least a portion of the electrically conductive material from the microelectronic substrate by passing a varying electrical current through the conductive material while engaging the conductive material with the material removal medium and moving at least one of the microelectronic substrate and the material removal medium relative to the other.

37. The method of claim 36 wherein the microelectronic substrate has an edge surface and a face surface and wherein the method further comprises:

interposing the polishing surface between the face surface and first and second electrodes;

coupling at least one of the first and second electrodes to a source of electrical potential; and

electrically coupling the first and second electrodes to the face surface of the microelectronic substrate through the polishing surface of the polishing pad.

38. The method of claim 36 wherein aligning the first and second portions of the microelectronic substrate includes aligning the first portion of the microelectronic substrate with the first portion of the material removal medium having a first electrical characteristic and aligning the second portion of the microelectronic substrate with the second portion of the material removal medium having a second electrical characteristic different than the first electrical characteristic.

39. The method of claim 38, further comprising selecting the first electrical characteristic to be a first conductivity and selecting the second electrical characteristic to be a second conductivity.

40. The method of claim 38, further comprising selecting the first electrical characteristic to be a first dielectric constant and selecting the second electrical characteristic to be a second dielectric constant.

41. The method of claim 36, further comprising engaging the first portion of the microelectronic substrate with a first electrolytic fluid and engaging a second portion of the microelectronic substrate with a second electrolytic fluid different than the first electrolytic fluid.

42. The method of claim 36, further comprising engaging the first portion of the microelectronic substrate with a first electrolytic fluid having a first

chemical concentration and engaging a second portion of the microelectronic substrate with a second electrolytic fluid having a second chemical concentration different than the first chemical concentration.

43. The method of claim 36, further comprising engaging the first portion of the microelectronic substrate with a first electrolytic fluid having a first chemical composition and engaging a second portion of the microelectronic substrate with a second electrolytic fluid having a second chemical composition different than the first chemical composition.

44. The method of claim 36 wherein the first portion of the material removal medium has a first impedance and the second portion of the material removal medium has a second impedance different than the first impedance and wherein the method further includes forming a first electrical circuit that includes the first impedance and forming a second electrical circuit that includes the second impedance.

45. The method of claim 36 wherein the material removal medium includes a polishing pad having the polishing surface and at least one electrode disposed proximate to the polishing surface, and wherein the method includes aligning the first portion of the microelectronic substrate to directly face at least one of the electrodes without the polishing pad being interposed between the first portion and the at least one electrode, and wherein the method further includes aligning the second portion of the microelectronic substrate to directly face a portion of the polishing pad positioned between at least one of the electrodes and the microelectronic substrate.

46. The method of claim 36 wherein the material removal medium includes a polishing pad having the polishing surface and at least one electrode positioned proximate to the polishing surface, the polishing pad having first pores

defining a first porosity and second pores defining a second porosity different than the first porosity, and wherein the method further comprises aligning the first portion of the microelectronic substrate with the first pores and aligning the second portion of the microelectronic substrate with the second pores.

47. The method of claim 36 wherein the material removal medium includes a polishing pad having the polishing surface and at least one electrode positioned proximate to the polishing surface, the polishing pad having a generally porous region and a generally non-porous region, and wherein the method further comprises aligning the first portion of the microelectronic substrate with the generally porous region and aligning the second portion of the microelectronic substrate with the generally non-porous region.

48. A method for removing electrically conductive material from a microelectronic substrate, comprising:

aligning a first portion of the microelectronic substrate with a first portion of a material removal medium having first electrical characteristics and aligning a second portion of the microelectronic substrate with a second portion of the material removal medium having second electrical characteristics different than the first electrical characteristics; and

removing at least part of the electrically conductive material from the microelectronic substrate by passing a varying electrical current through the material removal medium and the conductive material.

49. The method of claim 48 wherein the microelectronic substrate has an edge surface and a face surface and wherein the method further comprises:

interposing a polishing surface between the face surface and first and second electrodes;

coupling at least one of the first and second electrodes to the source of electrical potential; and

electrically coupling the first and second electrodes to the face surface of the microelectronic substrate through the polishing surface of the polishing pad.

50. The method of claim 48 wherein the part of the electrically conductive material removed from the microelectronic substrate is a first part, and wherein the material removal medium includes a polishing surface, and wherein the method further comprises:

engaging the conductive material with the polishing surface of the material removal medium; and

moving at least one of the polishing surface and the microelectronic substrate relative to the other to remove a second part of the electrically conductive material.

51. The method of claim 48 wherein aligning the first and second portions of the microelectronic substrate includes aligning the first portion of the microelectronic substrate with the first portion of the material removal medium having a first dielectric constant and aligning the second portion of the microelectronic substrate with the second portion of the material removal medium having a second dielectric constant different than the first dielectric constant.

52. The method of claim 48, further comprising engaging the first portion of the microelectronic substrate with a first electrolyte and engaging a second portion of the microelectronic substrate with a second electrolyte different than the first electrolyte.

53. The method of claim 48 wherein the material removal medium includes a polishing pad having a polishing surface and at least one electrode positioned proximate to the polishing surface, the polishing pad having first pores defining a first porosity and second pores defining a second porosity different than the first porosity, and wherein the method further comprises aligning the first

portion of the microelectronic substrate with the first pores and aligning the second portion of the microelectronic substrate with the second pores.

54. The method of claim 48 wherein the material removal medium includes a polishing pad having a polishing surface and at least one electrode positioned proximate to the polishing surface, the polishing pad having a generally porous region and a generally non-porous region, and wherein the method further comprises aligning the first portion of the microelectronic substrate with the generally porous region and aligning the second portion of the microelectronic substrate with the generally non-porous region.

55. A method for removing conductive material from a face surface of a microelectronic substrate, comprising:

electrically coupling a source of varying current to the conductive material on the face surface by coupling first and second electrodes to the source of varying current and facing the first and second electrodes toward the face surface of the microelectronic surface;

engaging the conductive material with a polishing pad having a polishing surface and moving at least one of the microelectronic substrate and the polishing surface relative to the other; and

controlling a rate and/or an amount of conductive material removed from the microelectronic substrate by controlling an interaction between the source of varying current and the conductive material and independently controlling an interaction between the polishing surface and the conductive material.

56. The method of claim 55 wherein controlling an amount of conductive material removed includes aligning a first portion of the microelectronic substrate with a first region of the polishing surface having a first dielectric constant and aligning a second portion of the microelectronic substrate with a second region

of the polishing surface having a second dielectric constant different than the first dielectric constant.

57. The method of claim 55 wherein controlling an amount of conductive material removed includes controlling a normal force applied to the conductive material at an interface between the conductive material and the polishing surface.

58. The method of claim 55 wherein controlling an amount of conductive material removed includes controlling an amount, ionic strength, and/or pH of an electrolytic fluid between the conductive material and an electrode coupled to the source of varying current.

59. The method of claim 55 wherein controlling an amount of conductive material removed includes controlling a voltage, current, waveform, and/or frequency of an electrical signal applied to the microelectronic substrate.

60. The method of claim 55 wherein controlling an amount of conductive material removed includes controlling a relative velocity between the polishing pad and the microelectronic substrate, controlling a normal force between the polishing pad and the microelectronic substrate, and/or selecting a configuration of the polishing pad.

61. The method of claim 55, further comprising removing gas from a region proximate to the microelectronic substrate.

62. A method for removing electrically conductive material from a face surface of a microelectronic substrate, comprising:

engaging the conductive material with a first electrolytic fluid and a polishing surface of a material removal medium;

removing at least a first portion of the electrically conductive material from the microelectronic substrate by passing a varying electrical current from a first electrode facing the face surface, through the first electrolytic fluid and the first conductive material to a second electrode facing the face surface while engaging the first conductive material with the material removal medium and moving at least one of the microelectronic substrate and the material removal medium relative to the other;

engaging the conductive material with a second electrolytic fluid and the polishing surface of the material removal medium, the second electrolytic fluid being different than the first electrolytic fluid; and

removing at least a second portion of the electrically conductive material from the microelectronic substrate by passing a varying electrical current from the first electrode facing the face surface, through the second electrolytic fluid and the second conductive material to the second electrode facing the face surface while engaging the second conductive material with the material removal medium and moving at least one of the microelectronic substrate and the material removal medium relative to the other.

63. The method of claim 62, further comprising selecting the first electrolytic fluid to have a first chemical concentration and selecting the second electrolytic fluid to have a second chemical concentration different than the first chemical concentration.

64. The method of claim 62, further comprising selecting the first electrolytic fluid to have a first chemical composition and selecting the second electrolytic fluid to have a second chemical composition different than the first chemical composition.

65. An apparatus for removing conductive material from a microelectronic substrate, comprising:

a support member configured to support a microelectronic substrate; and

a material removal medium proximate to the support member, the material removal medium including a first electrode and a second electrode positioned to be spaced apart from the microelectronic substrate when the microelectronic substrate is supported by the support member, at least one of the first and second electrodes being coupleable to a source of varying electrical current, the material removal medium further including a gas removal surface positioned to remove gas from a region proximate to the microelectronic substrate and/or at least one of the first and second electrodes during operation.

66. The apparatus of claim 65 wherein the microelectronic substrate has a face surface and an edge surface, and wherein the material removal medium includes a polishing surface disposed between the face surface and both the first and second electrodes during operation.

67. The apparatus of claim 65, further comprising a housing supporting the material removal medium, the housing being coupleable to a source of pressurized fluid, and wherein the material removal medium includes a polishing pad having a first surface facing inwardly toward an interior of the housing and a second surface engaged with the microelectronic substrate during operation, the second surface being biased against the microelectronic substrate when the housing is coupled to the source of pressurized fluid during operation.

68. The apparatus of claim 65, further comprising a housing supporting the material removal medium, the housing being coupleable to a source of pressurizing fluid, and wherein the material removal medium includes a polishing

pad having a first surface facing inwardly toward an interior of the housing and a second surface engaged with the microelectronic substrate during operation, the second surface being biased against the microelectronic substrate when the housing is coupled to the source of pressurizing fluid during operation, at least a portion of the first surface of the polishing pad being spaced apart from the first electrode to define a fluid passage, the fluid passage having an entrance coupleable to a source of electrolytic fluid, the fluid passage further having an exit.

69. The apparatus of claim 68, further comprising a vacuum source coupled to the exit of the fluid passage.

70. The apparatus of claim 65 wherein the material removal medium includes a polishing pad having a polishing surface positioned to engage the microelectronic substrate when the support member supports the microelectronic substrate.

71. The apparatus of claim 65 wherein the substrate support member is positioned to support the microelectronic substrate from below and the material removal medium is positioned above the substrate support.

72. The apparatus of claim 65 wherein at least one of the substrate support member and the material removal medium is rotatable at a rate sufficient to direct the gas radially outwardly and away from the microelectronic substrate.

73. The apparatus of claim 65, further comprising the microelectronic substrate.

74. The apparatus of claim 65, further comprising a liquid electrolyte disposed adjacent to the material removal medium.

75. The apparatus of claim 65 wherein the gas removal surface is one of a plurality of gas removal surfaces positioned to define a gas removal channel.

76. The apparatus of claim 65 wherein the material removal medium includes a medium support member supporting the first and second electrodes, and wherein the first and second electrodes each have a surface facing downwardly toward the microelectronic substrate during operation, and wherein the planarizing medium further includes a polishing pad positioned adjacent to at least one of the first and second electrodes and having the polishing surface facing downwardly and engaged with the microelectronic substrate during operation, the first and second electrodes being spaced apart from each other with the gas removal surface positioned above the microelectronic substrate during operation to collect the gas from the region proximate to the microelectronic substrate.

77. The apparatus of claim 65 wherein the first and second electrodes each have a surface facing downwardly toward the microelectronic substrate during operation, and wherein the gas removal surface is recessed into at least one of the downwardly facing surfaces.

78. The apparatus of claim 65 wherein the first and second electrodes each have a surface facing downwardly toward the microelectronic substrate during operation, and wherein at least one of the downwardly facing surfaces is non-horizontal to conduct gas away from the region proximate to the microelectronic substrate.

79. The apparatus of claim 65 wherein the material removal medium includes a porous polishing pad having a polishing surface with pores facing toward the microelectronic substrate during operation, and wherein the gas

removal surface is in fluid communication with at least one of the pores to conduct gas away from the region.

80. An apparatus for removing conductive material from a microelectronic substrate, comprising:

a support member configured to support a microelectronic substrate;

a material removal medium proximate to the support member, the material removal medium including a first electrode and a second electrode each positioned to be spaced apart from the microelectronic substrate when the microelectronic substrate is supported by the support member, at least one of the first and second electrodes being coupleable to a source of varying electrical current; and

an ultrasonic energy emitter positioned proximate to the material removal medium to remove gas from a region proximate to the microelectronic substrate and/or at least one of the first and second electrodes during operation.

81. The apparatus of claim 80 wherein the ultrasonic energy emitter is positioned to contact an electrolytic fluid when the electrolytic fluid is disposed between the microelectronic substrate and at least one of the first and second electrodes.

82. The apparatus of claim 80 wherein the material removal medium further includes a gas removal surface positioned to remove the gas from the region proximate to the microelectronic substrate and/or at least one of the first and second electrodes during operation.

83. The apparatus of claim 80 wherein the material removal medium includes a polishing pad having a polishing surface positioned to engage the microelectronic substrate when the support member supports the microelectronic substrate.

84. An apparatus for removing conductive material from a microelectronic substrate, comprising:

a substrate support member configured to support a microelectronic substrate;

a material removal medium proximate to the substrate support member and having a polishing surface positioned to engage the microelectronic substrate when the microelectronic substrate is supported by the substrate support member, at least one of the material removal medium and the substrate support member being movable relative to the other, the material removal medium further having a first electrode at least proximate to the polishing surface and a second electrode at least proximate to the polishing surface and spaced apart from the first electrode, at least one of the first and second electrodes being coupleable to a source of varying electrical current, at least one of the substrate support member and the planarizing medium having a gas removal surface positioned to receive and remove gas from a region proximate to the microelectronic substrate during operation.

85. The apparatus of claim 84 wherein the microelectronic substrate has a face surface and an edge surface, and wherein the material removal medium includes a polishing surface disposed between the face surface and both the first and second electrodes during operation.

86. The apparatus of claim 84, further comprising the source of varying electrical current, and wherein the source coupled to at least one of the electrodes to transmit to the at least one electrode alternating current and/or pulsed direct current.

87. The apparatus of claim 84 wherein the substrate support is positioned to support the microelectronic substrate from below and the polishing

surface is positioned to engage an upward facing surface of the microelectronic substrate.

88. The apparatus of claim 84, further comprising the microelectronic substrate.

89. The apparatus of claim 84 wherein the polishing surface has pores facing toward the microelectronic substrate during operation, and wherein the gas removal surface is in fluid communication with at least one of the pores to conduct gas away from the region proximate to the microelectronic substrate.

90. The apparatus of claim 84, further comprising a housing supporting the material removal medium, the housing being coupleable to a source of pressurizing fluid, and wherein the material removal medium includes a polishing pad having a first surface facing inwardly toward an interior of the housing and a second surface engaged with the microelectronic substrate during operation, the second surface being biased against the microelectronic substrate when the housing is coupled to the source of pressurizing fluid during operation, at least a portion of the first surface of the polishing pad being spaced apart from the first electrode to define a fluid passage, the fluid passage having an entrance coupleable to a source of electrolytic fluid and an exit, the fluid passage being positioned to entrain gas from at least one of first electrode and the first surface of the polishing pad.

91. An apparatus for removing conductive material from a face surface of a microelectronic substrate, comprising:

a substrate support member configured to support a microelectronic substrate; and

a material removal medium positioned proximate to the substrate support member, the material removal medium having a medium support member and first and second electrodes supported by the medium support member, both the

first and second electrodes facing toward the face surface of the microelectronic substrate during operation, the material removal medium further including a polishing pad at least proximate to the first and second electrodes and engaged with the microelectronic substrate when the substrate support member support the microelectronic substrate.

92. The apparatus of claim 91 wherein the polishing pad is interposed between at least a portion of the electrode surfaces and the microelectronic substrate during operation.

93. The apparatus of claim 91 wherein the polishing pad depends from at least one of the least electrodes.

94. The apparatus of claim 91 wherein the material removal medium further includes a gas removal surface positioned to receive and remove gas from a region proximate to the microelectronic substrate during operation.

95. The apparatus of claim 91 wherein the material removal medium has first and second regions positioned to be electrically coupled to the microelectronic substrate, the first region having a first electrical characteristic, the second region having a second electrical characteristic different than the first electrical characteristic.

96. An apparatus for removing conductive material from a microelectronic substrate, comprising:

a support member configured to support a microelectronic substrate; and

a material removal medium proximate to the support member and having a polishing surface positioned to engage the microelectronic substrate when the microelectronic substrate is supported by the support member, at least one of the

material removal medium and the support member being movable relative to the other, the material removal medium having a first region with a first electrical characteristic and a second region with a second electrical characteristic different than the first electrical characteristic, the first region being aligned with a first portion of the microelectronic substrate and the second region being aligned with a second portion of the microelectronic substrate when the polishing surface is engaged with the microelectronic substrate, the material removal medium further including a first electrode proximate to the polishing surface and a second electrode proximate to the polishing surface, at least one of the first and second electrodes being coupleable to a source of varying electrical current.

97. The apparatus of claim 96 wherein the material removal medium includes a polishing pad having the polishing surface, further wherein the polishing pad has a first dielectric constant in the first region and a second dielectric constant in the second region, the first dielectric constant being different than the second dielectric constant.

98. The apparatus of claim 96 wherein the material removal medium includes a polishing pad having the polishing surface, the polishing pad being generally porous in the first region and generally non-porous in the second region.

99. The apparatus of claim 96 wherein the material removal medium includes a polishing pad having the polishing surface, the polishing pad having a first porosity in the first region and a second porosity different than the first porosity in the second region.

100. The apparatus of claim 96 wherein the material removal medium includes a generally porous polishing pad having the polishing surface, and wherein the material removal medium further includes a generally non-porous

blocking material adjacent to the polishing pad in the first region to block pores of the polishing pad in the first region.

101. An apparatus for removing conductive material from a microelectronic substrate, comprising:

a support member configured to support a microelectronic substrate; and

a material removal medium proximate to the support member and having a first region with a first electrical characteristic and a second region with a second electrical characteristic different than the first electrical characteristic, the first region being aligned with a first portion of the microelectronic substrate and the second region being aligned with a second portion of the microelectronic substrate when the support member supports the microelectronic substrate, the material removal medium further including a first electrode and a second electrode at least proximate to the microelectronic substrate when the microelectronic substrate is supported by the support member, at least one of the first and second electrodes being coupleable to a source of varying electrical current.

102. The apparatus of claim 101 wherein the material removal medium further includes a polishing pad having a polishing surface positioned to engage the microelectronic substrate during operation.

103. The apparatus of claim 101 wherein the material removal medium includes a polishing pad having a polishing surface positioned to engage the microelectronic substrate during operation, further wherein the polishing pad has a first dielectric constant in the first region and a second dielectric constant in the second region, the first dielectric constant being different than the second dielectric constant.

104. The apparatus of claim 101 wherein the material removal medium includes a polishing pad having a polishing surface positioned to engage the microelectronic substrate during operation, the polishing pad being generally porous in the first region and generally non-porous in the second region.

105. The apparatus of claim 101 wherein the material removal medium includes a polishing pad having a polishing surface positioned to engage the microelectronic substrate during operation, the polishing pad having a first porosity in the first region and a second porosity different than the first porosity in the second region.

106. The apparatus of claim 101 wherein the material removal medium includes a generally porous polishing pad having a polishing surface positioned to engage the microelectronic substrate during operation, and wherein the material removal medium further includes a generally non-porous blocking material adjacent to the polishing pad in the first region to block pores of the polishing pad in the first region.

107. The apparatus of claim 101 wherein the material removal medium includes a first electrolytic fluid in the first region and a second electrolytic fluid in the second region, the second electrolytic fluid being different than the first electrolytic fluid.